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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/022,665
Filing Date: December 18, 2001
Appellant(s): AZADET ET AL.

Kevin M. Mason
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 01/18/2007 appealing from the Office action mailed 10/13/2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,031,195	CHEVILLAT et al	7-1991
5,963,592	KIM	10-1999

4,713,829 EYUBOGLU 12-1987

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1, 21, 26, 27 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chevillat; Pierre R. et al. (US 5031195 A, hereafter referred to as Chevillat) in view of Kim; Young-Sang (US 5963592 A).

35 U.S.C. 103(a) rejection of claims 1 and 21.

Chevillat teaches compensating for intersymbol interference caused by previously transmitted multidimensional code symbols by calculating intersymbol interference

estimates based on one or more multidimensional code symbols (the Abstract in Chevillat teaches 2-dimensional trellis coded symbols; col. 5, lines 8-17 in Chevillat eaches $M_n(..a_n)$ is a estimates based on one or more multidimensional trellis code symbols; col. 5, lines 46 in Chevillat teaches compensating for intersymbol interference caused by previously transmitted multidimensional code symbols by calculating intersymbol interference estimates $M_n(..a_n)$ based on one or more multidimensional code symbols a_n).

The Examiner asserts that intersymbol and intrasymbol interference are a type of noise due to multi-path fading, which causes errors in received data. The Viterbi Decoder in Figure 7 is a forward error correction encoder for correcting errors due to any noise in a transmitted signal, that is, a Viterbi decoder is a device for compensating for noise in a transmitted symbol by correcting the transmitted signal.

However Chevillat does not explicitly teach the specific use of taking specific compensatory actions designed specifically for intrasymbol interference.

Kim, in an analogous art, teaches use of taking specific compensatory actions designed specifically for intrasymbol interference (col. 9, lines 8-13 in Kim teach taking the specific compensatory actions designed specifically for intrasymbol interference of "updating the in-phase and quadrature phase filtering coefficients").

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chevillat with the teachings of Kim by including use of taking specific compensatory actions designed specifically for intrasymbol interference. This modification would have been obvious to one of ordinary skill in the art, at the time

the invention was made, because one of ordinary skill in the art would have recognized that use of taking specific compensatory actions designed specifically for intrasymbol interference would have provided adaptation for abrupt changes in the channel environment (col. 3, lines 1-5 in Kim).

35 U.S.C. 103(a) rejection of claim 26.

Col. 5, lines 18-34 in Chevillat teaches that ISI terms not represented the truncated surviving path are subtracted to create ISI free estimates.

35 U.S.C. 103(a) rejection of claim 27.

Col. 5, lines 18-34 in Chevillat teaches that ISI terms not represented the truncated surviving path are subtracted to create ISI free estimates. Past symbols are first symbols are current symbols are subsequent.

35 U.S.C. 103(a) rejection of claim 33.

Chevillat teaches compensating for intersymbol interference caused by previously transmitted multidimensional code symbols by calculating intersymbol interference estimates based on one or more multidimensional code symbols (the Abstract in Chevillat teaches 2-dimensional trellis coded symbols; col. 5, lines 8-17 in Chevillat eaches $M_n(..a_n)$ is a estimates based on one or more multidimensional trellis code symbols; col. 5, lines 46 in Chevillat teaches compensating for intersymbol interference caused by previously transmitted multidimensional code symbols by calculating

intersymbol interference estimates $M_n(..a_n)$ based on one or more multidimensional code symbols a_n).

The Examiner asserts that intersymbol and intrasymbol interference are a type of noise due to multi-path fading, which causes errors in received data and a Viterbi detector is a device with a branch metric unit use for correcting errors due to any noise in a transmitted signal, that is, the branch metric unit in a Viterbi decoder is a device for compensating for noise in a transmitted symbol by correcting the transmitted signal.

However Chevillat does not explicitly teach the specific use of taking specific compensatory actions designed specifically for intrasymbol interference.

Kim, in an analogous art, teaches use of taking specific compensatory actions designed specifically for intrasymbol interference (col. 9, lines 8-13 in Kim teach taking the specific compensatory actions designed specifically for intrasymbol interference of "updating the in-phase and quadrature phase filtering coefficients").

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chevillat with the teachings of Kim by including use of taking specific compensatory actions designed specifically for intrasymbol interference.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of taking specific compensatory actions designed specifically for intrasymbol interference would have provided adaptation for abrupt changes in the channel environment (col. 3, lines 1-5 in Kim).

2. Claims 2-4, 9, 10, 22-25 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chevillat; Pierre R. et al. (US 5031195 A, hereafter referred to as Chevillat) and Kim; Young-Sang (US 5963592 A) in view of Eyuboglu; Vedat M. (US 4713829 A).

35 U.S.C. 103(a) rejection of claim 2.

Chevillat and Kim substantially teaches the claimed invention described in claim 1 (as rejected above).

However Chevillat and Kim does not explicitly teach the specific use of multidimensional Trellis code constellations.

Eyuboglu, in an analogous art, teaches use of multidimensional Trellis code constellations (Column 8 and 4D Block Encoder 97 in Figure 7 of Eyuboglu teach 4D coded information mapped onto a 4D constellation; A 4D constellation must be transmitted over more than on transmission frame or interval).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chevillat and Kim with the teachings of Eyuboglu by including use of multidimensional Trellis code constellations. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of multidimensional Trellis code constellations would have provided better performance for a given level of complexity.

35 U.S.C. 103(a) rejection of claims 3 and 34.

Col. 6, lines 15-16 in Eyuboglu teaches a modulator for providing in-phase I and quadrature Q coordinates or channels. Column 8 and 4D Block Encoder 97 in Figure 7 of Eyuboglu teach 4D coded information mapped onto a 4D constellation.

35 U.S.C. 103(a) rejection of claim 4.

Eyuboglu teaches calculating intersymbol interference estimates based on said previously decoded multidimensional code symbols (col. 4, lines 61-65 in Eyuboglu teaches a preferred embodiment using a noise predictor for compensating for intersymbol interference caused by previously decoded multidimensional code symbols by offsetting received signals by a calculated noise prediction value that is based on prior received signals; a calculated noise prediction value is an intersymbol interference estimate based on prior received signals); calculating intrasymbol interference estimates based on possible data symbol values (col. 9, lines 8-13 in Kim teach taking the specific compensatory actions designed specifically for intrasymbol interference of "updating the in-phase and quadrature phase filtering coefficients"; updated in-phase and quadrature phase filtering coefficients are intrasymbol interference estimates based on possible data symbol values); and calculating branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates (col. 3, lines 1-2 in Eyuboglu teach that branch metrics are calculated based on a received signal and said intersymbol interference and since the Viterbi detector 48 in Figure 4 of Eyuboglu receives input from Equalizer 44 the input of the Viterbi detector is based on

intrasymbol interference estimates of the Equalizer; hence the branch metrics calculated form the input to Viterbi detector 48 are also based on intrasymbol interference estimates of the Equalizer).

35 U.S.C. 103(a) rejection of claim 9.

Col. 10, lines 20-26 in Eyuboglu. Note: the estimated path is the surviving path.

35 U.S.C. 103(a) rejection of claim 10.

Col. 3, lines 56-61 in Eyuboglu.

35 U.S.C. 103(a) rejection of claim 22.

Predictor coefficients b_{new} in col. 11, lines 19-65 in Eyuboglu are metrics used in the calculation of 2D branch metrics (col. 12, lines 1-10 in Eyuboglu) using previous surviving received signals $r_{1,old}$ and $r_{2,old}$.

Col. 11, lines 19-65 in Eyuboglu teaches calculating a Predictor coefficient metric for an initial symbol component using previous survivor symbols $r_{1,old}$ and $r_{2,old}$ from a corresponding state to account for intersymbol interference, wherein said metric is ultimately used for the calculation of a branch metric (col. 12, lines 1-10 in Eyuboglu).

35 U.S.C. 103(a) rejection of claim 23.

Eyuboglu teaches calculating a metric for an subsequent symbol component $r'_{1,new}$ and $r'_{2,new}$ using survivor symbols received signals $r_{1,old}$ and $r_{2,old}$ from a corresponding state

to account for intersymbol interference and using at least one data estimate $r_{1,new}$ and $r_{2,new}$ to account for intrasymbol interference

35 U.S.C. 103(a) rejection of claim 24.

Eyuboglu teaches calculating a combined 2D branch metric by combining said metric b_{old} for said initial symbol component (col. 11, lines 45-46 in Eyuboglu) and said metric b_{new} for said subsequent symbol component (col. 11, lines 60-68 in Eyuboglu).

35 U.S.C. 103(a) rejection of claim 25.

Eyuboglu teaches commputing a 4D branch metric for a transition in a multidimensional trellis using said combined 2D branch metric (col. 12, lines 30-31 in Eyuboglu).

Allowable Subject Matter

3. Claims 28-32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(10) Response to Argument

On page 4, paragraph 1 of the Appellant's Appeal brief, the Appellant contends, "In order to simplify the issues that me presented the appeal, Appellants submit that neither Chevillat nor Kim, separately or in combination, disclose or suggest compensating for ***intra***symbol interference caused by symbol components within a current multidimensional code symbol".

The Examiner disagrees and asserts that col. 9, lines 8-13 in Kim teach taking the specific compensatory actions designed specifically for intrasymbol interference of "updating the in-phase and quadrature phase filtering coefficients". In-phase error and quadrature phase error components (as taught in the Abstract of Kim) are one dimensional components of a two-dimensional code symbol (Note: in-phase refers to the 1-dimensional cos[w_c t] carrier and quadrature phase refers to 1-dimensional sin[w_c t] carrier of a transmitted two dimensional symbol). Col. 9, lines 8-13 in Kim explicitly teaches compensating for ***intra***symbol interference caused by 1-dimensional In-phase error and 1-dimensional quadrature phase error symbol components within a current two-dimensional multidimensional code symbol.

On page 4, paragraph 2 of the Appellant's Appeal brief, the Appellant contends, ""multidimensional code symbol"' is defined in the preamble to comprise "a number of symbol components of lower dimensionality," and thus, this recitation must be given patentable weight".

The Examiner asserts that even if it is given patentable weight, col. 9, lines 8-13 in Kim explicitly teaches compensating for ***intra***symbol interference caused by 1-dimensional In-phase error and 1-dimensional quadrature phase error symbol components within a current two-dimensional multidimensional code symbol (see previous argument for details).

On page 4, paragraph 3 of the Appellant's Appeal brief, the Appellant contends, "Despite the comments of the Examiner in the Advisory Action, the preamble recitation "a number of' symbol components of' lower dimensionality," does not merely recite the propose of a process or the intended use of a structure In fact, the body of the claim most certainly depends on the preamble for completeness, Thus, the Examiner's own cited case law is not even applicable here is no basis in law or fact for overlooking the explicit definition of the term "multidimensional code symbol," in the manner suggested by the Examiner'."

The Examiner asserts that the Appellant misinterprets the Examiner's assertions. Intrasymbol interference, by definition, is interference cause by internal components of a symbol so that anyone who compensates for intrasymbol inference inherently compensates for intrasymbol inference "caused by symbol components within a current multidimensional code symbol". That is, "caused by symbol components within a current multidimensional code symbol" adds nothing to the statement "compensating for ***intra***symbol interference". However as pointed out, above, the Examiner does not have to rely on inherency since col. 9, lines 8-13 in Kim explicitly teaches compensating for ***intra***symbol interference caused by 1-dimensional In-phase error and 1-dimensional quadrature phase error symbol components within a current two-dimensional multidimensional code symbol (see previous argument for details).

On page 5, paragraph 1 of the Appellant's Appeal brief, the Appellant contends, "Appellants respectfully submit that the Examiner has tailed to establish a prima facie

case of obviousness for at least the reason that there exists no motivation to combine the references, and further, even if combinable, the references collectively do not teach each and every limitation of the independent claims. See, e.g, MP.EP. §2143. Also, there is no reasonable expectation of success".

The Examiner disagrees and asserts that col. 3, lines 1-5 in Kim teach motivation to combine: col. 3, lines 1-5 in Kim teach that use of taking specific compensatory actions designed specifically for intrasymbol interference would have provided adaptation for abrupt changes in the channel environment. Both the Chevillat and Kim patent are directed to adaptive equalizers for adapting channel reception to channel environment. The Chevillat and Kim patent complement each other; one provides compensation for intersymbol interference and the other for intra-symbol interference.

On page 5, paragraph 2 of the Appellant's Appeal brief, the Appellant contends, "Kim does not disclose or suggest compensating for intrasymbol interference within multidimensional code symbols. Kim defines intrasymbol interference in the context of in-phase and quadrature-phase filtering in an OFDM transceiver' without consideration of coding Appellants again respectfully request the Examiner to specifically identify any suggestion of a multidimensional code in Kim".

The Examiner asserts that the Abstract and Figure 3 in Chevillat teaches 2-dimensional trellis coded symbols.

On page 5, paragraphs 3 and 4 of the Appellant's Appeal brief, the Appellant contends, "The Examiner asserts that it would be obvious to modify Chevillat with the teachings of' Kim by including the use of' taking specific compensatory actions for intrasymbol interference, because one of ordinary skill in the art would have recognized that such compensatory actions would have provided adaptation for abrupt changes in the channel., First, since Kim is not even directed to a coded system, a person of ordinary skill in the art would not even look to Kim for a solution to the problem addressed by the present invention, namely, the decoding of multidimensional codes,, thus, a person of ordinary skill would not combine Chevillat and Kim".

The Examiner asserts that Figure 7 in Chevillat teaches Equalizer 40 for compensating for intersymbol interference followed by a Viterbi decoder for 2-dimensional trellis coded symbols whereas Kim is directed to compensating for intrasymbol interference in an equalizer for received 2-dimensional symbols. A received 2-dimensional trellis coded symbol is a still a 2-dimensional symbol and the Equalizer in Kim would operate on any 2-dimensional symbol as taught in Kim compensating for intrasymbol interference. Chevillat teaches that if the 2-dimensional symbol in Kim is a 2-dimensional trellis coded symbol, a Viterbi decoder to decode the 2-dimensional trellis coded symbol must follow the Equalizer in Kim. As pointed out, above, the Chevillat and Kim patent complement each other and col. 3, lines 1-5 in Kim explicitly teaches motivation: compensatory actions designed specifically for intrasymbol interference would have provided adaptation for abrupt changes in the channel environment.

On page 5, paragraph 5 of the Appellant's Appeal brief, the Appellant contends, "Second, the Examiner seems to rely on the general notion that "intersymbol and intrasymbot interference are a type of' noise due to multi-path fading, causing errors in the received data," in support of a motivation to combine, Appellants note, however, that intersymbol and intrasymbol interference are distinct and independent types of channel impairments, each requiring specific treatment".

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "each requiring specific treatment") are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

The Examiner asserts Claim 1 recites no specific treatment for intrasymbol interference and only recites compensating for intrasymbol interference. Even if it did, col. 9, lines 8-13 in Kim explicitly teaches compensating for ***intra***symbol interference caused by 1-dimensional In-phase error and 1-dimensional quadrature phase error symbol components within a current two-dimensional multidimensional code symbol (see previous argument for details).

Second of all, error correction or equalization used to compensate for noise is a method for compensating for both intrasymbol interference and intersymbol interference since intrasymbol interference and intersymbol interference are a specific type of noise. Hence the Viterbi detector in Chevillat is a also method for compensating for

intrasymbol interference since it designed to compensate for any noise that may occur in a channel.

On page 5, paragraph 5 of the Appellant's Appeal brief, the Appellant contends, "A solution that compensates for intersymbol interference does not suggest a solution that compensates for intrasymbol interference".

That is true, however; the Viterbi detector in Chevillat is a also method for compensating for intrasymbol interference since it designed to compensate for any noise that may occur in a channel and intrasymbol interference is noise. In addition, col. 9, lines 8-13 in Kim explicitly teaches compensating for ***intra***symbol interference caused by 1-dimensional In-phase error and 1-dimensional quadrature phase error symbol components within a current two-dimensional multidimensional code symbol (see previous argument for details).

On page 6, paragraph 1 of the Appellant's Appeal brief, the Appellant contends, "Also, there is no reasonable expectation of success for the combination of Chevillat and Kim, Kim suggests to "to remove intrasymbol interference by updating the in-phase and quadrature phase filtering coefficients by utilizing the pilot signal," which is different from "compensating for intrasymbol interference caused by symbol components within a cmient multidimensional code symbol" Kim addresses the removal of intrasymbol interference for an uncoded symbol comprising I and Q coordinates, whereas claim 1 addresses the compensation of intrasymbol interference caused by symbol components

within a current multidimensional code symbol., It is not clear to Appellants how the removal of in-phase and quadratu-phase filtering coefficients by utilizing the pilot signal leads to the compensation of' intrasymbol interference caused by symbol components within a current code symbol".

I coordinates are in-phase coordinates and Q coordinates are quadrature phase coordinates. Kim teaches compensating for 2-dimensional symbols by in-phase 1-dimensional I coordinate component errors and quadrature 1-dimensional Q coordinate component errors. Nowhere does Kim refer to an uncoded symbol; that is one of the Appellant's fabrications. The Equalizer in Kim is operative to receive and equalize any received 2-dimensional symbol.

On page 7, paragraph 1 of the Appellant's Appeal brief, the Appellant contends, "Claim 2 requires wherein multidimensional code symbols axe transmitted over more than one symbol interval that is used to transmit one of said symbol components and claim 4 requires calculating intrasymboi interference estimates based on possible data symbol values; and calculating branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates".

Claim 2 recites the following language "wherein said multidimensional code symbol comprises a number of transmitted symbol components of lower dimensionality that exceeds a number of available channels".

The Examiner asserts that the Abstract in Eyuboglu teaches a single transmission channel for multi-dimensional codes in Figure 7.

In addition I and Q coordinates in Kim are subchannels of a single channel for a symbol.

Claim 4 recites, "calculating intersymbol interference estimates based on said previously decoded multidimensional code symbols; calculating intrasymbol interference estimates based on possible data symbol values; and calculating branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates".

Eyuboglu teaches calculating intersymbol interference estimates based on said previously decoded multidimensional code symbols (col. 4, lines 61-65 in Eyuboglu teaches a preferred embodiment using a noise predictor for compensating for intersymbol interference caused by previously decoded multidimensional code symbols by offsetting received signals by a calculated noise prediction value that is based on prior received signals; a calculated noise prediction value is an intersymbol interference estimate based on prior received signals); calculating intrasymbol interference estimates based on possible data symbol values (col. 9, lines 8-13 in Kim teach taking the specific compensatory actions designed specifically for intrasymbol interference of "updating the in-phase and quadrature phase filtering coefficients"; updated in-phase and quadrature phase filtering coefficients are intrasymbol interference estimates based on possible data symbol values); and calculating branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates (col. 3, lines 1-2 in Eyuboglu teach that branch metrics are calculated based on a received signal and said intersymbol interference and since the Viterbi detector 48 in Figure 4 of

Eyuboglu receives input from Equalizer 44 the input of the Viterbi detector is based on intrasymbol interference estimates of the Equalizer; hence the branch metrics calculated form the input to Viterbi detector 48 are also based on intrasymbol interference estimates of the Equalizer).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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